UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 9
75 Hawthorne Street
San Francisco, CA 94105-3901

Addendum to Monolithic Memories, Inc (Advanced Micro Devices - Arques) Five Year Review Report, March 30, 2012

The Third Five-Year Review Report (Report) for the Monolithic Memories, Inc (Advanced Micro Devices - Arques) Site in Sunnyvale, California, was approved by Stephen Hill, California Regional Water Control Board, San Francisco Bay region, and concurred by Kathleen Salyer, Assistant Director, Superfund on September 30, 2009. The protectiveness determination was deferred because the potential for vapor intrusion from the groundwater contamination of PCE to an office building on the property and an adjacent daycare. The statement in the Report regarding protectiveness was as follows:

> "A protectiveness determination of the remedy at Monolithic Memories, Inc (Advanced Micro Devices - Arques) cannot be made at this time until further information is obtained concerning the potential for vapor intrusion. Further information will be obtained from collecting and analyzing soil gas and possibly indoor air samples at 1160 Kern Avenue building and the need for a further restrictive covenant at that property will be assessed. The historical data from biannual vapor sampling data from the 1155 East Arques Avenue location (KinderCare) will be analyzed to verify protectiveness. It is expected that these actions will take approximately one year to complete.
>
> Although the historical groundwater plume was reduced and contained, current information indicates that the selected remedy may not be able to restore the groundwater to its beneficial use as a potential drinking water supply. The recent PCE spill has increased concentrations on property and has not been fully assessed. Currently, the institutional controls are preventing exposure to, and the ingestion of, contaminated groundwater. The feasibility of alternative remedies or improvements to the existing system need to be evaluated to insure the long term remedial objectives are achieved."

This addendum addresses the Protectiveness Statement.

Progress Since the Five-Year Review Completion Date

Background

The Monolithic Memories Site is a former semiconductor fabrication facility. The Site lies to the north of another federal Superfund Site, the National Semiconductor Corporation. Historically, groundwater contamination at MMI has commingled with groundwater contamination from

National Semiconductor Corporation into a commingled plume. There are four water bearing units beneath the Site, with the shallowest water between 5 and 25 feet below ground surface. The primary chemicals currently associated with the Site are PCE, TCE, Vinyl Chloride and other VOCs.

There is one building on the property at 1160 Kern Avenue. The 1160 Kern property is currently owned by RAFT, a non-profit organization for teachers, which operates a warehouse at the site. The majority of the building space is for storage with a few offices and a volunteer room. The building uses natural ventilation in the warehouse during the summer and a heating system in the winter. The offices have a heating and air conditioning system that is used when needed. Figure 3 shows the building layout of 1160 Kern Ave. Building. Adjacent to the property is a building at 1155 Arques Avenue. The building is currently used as a daycare (Kindercare). Two former buildings on the property that were used during semiconductor fabrication operations have been demolished. Figure 2 shows the Site Plan.

Vapor Intrusion Data & Analysis – On-site Building at 1160 Kern Avenue

In August 2011, AMD conducted indoor air sampling in the building at the site in order to evaluate the potential for subsurface vapor intrusion. Samples were collected from six locations within the building, as well as from two outdoor locations, and analyzed for volatile organic compounds (VOCs) that have been reported in groundwater in the vicinity of the site.

The results were reported in the *Report of Results—Indoor Air Sampling* (AMEC, 2011), and suggested that vapor intrusion is likely occurring at the site, based on the detections of the same VOCs in indoor air that have been detected in groundwater samples from monitoring wells in the area. PCE and TCE were detected in indoor air at concentrations slightly above screening criteria in breathing zone samples from two rooms in the site building. Furthermore, a potential preferential pathway was identified in the women's restroom, based on the higher concentrations of PCE and TCE near a floor drain than in other areas of the building.

Based on the results of the August 2011 investigation, the Water Board requested that AMD undertake mitigation measures in the women's restroom, where PCE and TCE levels were elevated, and perform confirmation sampling. In November, 2011, AMEC personnel performed a site visit to attempt to better evaluate potential preferential pathways within the women's restroom inside the warehouse portion of the building, as well as within the other restrooms. AMEC also inspected the drains within the restrooms, in order to help evaluate possible mitigation methods. Six floor drains were identified at the site in total. The seals between the drains and surrounding floor appeared to be intact. Although no preferential pathways were identified during the November 2011 site visit, it was assumed that the floor drains were the most likely pathway for subsurface VOCs to enter indoor air, because PID readings as high as 43 ppbv were previously measured in one of the floor drains during a previous site visit.

Because the drain seals appeared to be intact, AMEC assumed that the source of VOCs to indoor air was the drain line itself, potentially due to cracks in the drain line beneath the surface, allowing soil vapor to enter the drain line. The drains at the site are infrequently used; therefore, a lack of water in the drain trap could have allowed vapors potentially present in the drains to enter the room. In order to mitigate the potential for vapor intrusion from the drains, AMEC chose to install drain inserts, which allow water to drain out, while preventing vapors from entering the room.

A second set of indoor air samples were collected post mitigation on December 22, 2011. Results from the pre-mitigation sampling and post-mitigation sampling is presented below in Table 1. The results were reported in *Addendum to Report of Results—Indoor Air Sampling* (AMEC, 2012).

Table 1 – Indoor Air sampling 1160 Kern Avenue

Sample ID	Sample Type	Location	Date Collected	PCE	TCE	Freon 113	Vinyl Chloride
August 2011 Sampling (Pre-Mitigation)							
AMB-1	Ambient	Parking lot	8/21/2011	<0.14	<0.027	0.79	<0.013
AMB-2	Ambient	Roof	8/21/2011	<0.14	0.053	0.74	<0.013
IA-1	Breathing Zone	Warehouse/storage	8/21/2011	1.6	1.2	0.75	<0.013
IA-10	Blind Field Duplicate		8/21/2011	1.4	1.2	0.66	<0.013
IA-2	Preferential Pathway	Women's rest room in warehouse	8/21/2011	**14**	**27**	1.4	**0.017**
IA-3	Breathing Zone	Conference room	8/21/2011	**2.1**	1.6	0.83	<0.013
IA-4	Breathing Zone	Lobby	8/21/2011	1.0	0.84	0.71	<0.013
December 2011 Sampling (Post-Mitigation)							
AMB-3	Ambient	Parking lot	12/22/2011	<0.14	0.040	0.70 J	<0.013
IA-2R	Preferential Pathway	Women's rest room in warehouse	12/22/2011	**3.7**	**6.9**	1.1 J	<0.013
IA-20R	Preferential Pathway	Women's rest room in warehouse	12/22/2011	**4.2**	**7.6**	1.5 J	<0.013
IA-7	Preferential Pathway	Mens rest room in warehouse	12/22/2011	1.2	1.3	0.74 J	<0.013
IA-8	Preferential	Mens rest room off	12/22/2011	1.4	1.4	0.76 J	<0.013

	Pathway	lobby					
IA-9	Preferential Pathway	Women's rest room off lobby	12/22/2011	1.5	2.0	0.79 J	<0.013

Indoor air results can be compared to U.S. EPA Regional Screening Levels (RSLs) for indoor air in industrial buildings The RSLs are long-term screening levels that correspond to an excess risk level of $1x10^{-6}$, below which remedial action would not be required. The current RSL for PCE is 2.1 $\mu g/m^3$, for vinyl chloride is 2.8 $\mu g/m^3$, and for Freon is 13,000 $\mu g/m^3$.

In November 2011, EPA completed a review of the TCE toxicity literature on IRIS both cancer and noncancer toxicity values which resulted in a lower value for RSLs for TCE. For industrial exposures, assuming an 8-hour work day, the screening level for chronic exposure is 3.0 $\mu g/m^3$. Also, as a result of the November 2011 TCE reassessment, a not-to-be exceeded values for TCE on a 24 hour time-weighted average, was developed to account for the effect of short-term exposure on neonatal development. Exceedances of the short-term RSL would trigger the need for remedial measures to reduce exposures to below media concentrations that are calculated using those values regardless of estimated excess lifetime cancer risks from exposure to TCE from the same media. The 8-hour not-to-exceed screening level for TCE is 6.0 $\mu g/m^3$.

Although mitigation measures reduced the concentration of TCE in indoor air for 27 $\mu g/m^3$ to 6.9 $\mu g/m^3$ (7.6 $\mu g/m^3$ in duplicate sample), the concentrations of TCE in indoor air exceed the chronic level for TCE and the not-to-exceed level for indoor air screening level. PCE indoor air levels were also reduced between pre-mitigation and post-mitigation, but still exceed the screening levels.

(please input on conclusions and recommendations)

Vapor Intrusion Analysis –Building at 1155 East Arques Avenue

On July 15, 2005, a transformer located on a pad in the northwest corner of the former building at 1165 E. Arques Avenue was damaged, spilling approximately 250 gallons of PCE to the ground, which subsequently migrated into underlying soils and groundwater. The closet building to the former spill is 1155 E. Arques Ave. Under direction of the RWQCB, remedial efforts have been conducted to address the release including multiple soils excavations removing a total of 3,100 tons of soil, operation of a multiphase extraction system for eleven months, and an enhanced reductive dechlorination injection event. These activities have significantly reduced PCE concentrations in soil gas, soil, and groundwater at and in the vicinity of the property. In addition, an SVE system was operated until 2008 at this location to address the spill.

On September 10, 2005, soil gas samples were collected from five temporary soil gas probes located at the 1155 E. Arques property. The samples collected yielded concentrations of VOCs above RWQCB's Screening Levels (ESLs). Subsequently, indoor air samples were collected from within the building at the 1155 property on October 23, 2005, which also yielded VOCs above ESLs. Since that time, indoor air samples have been collected annually until 2010. The samples, up to and including the 2009 event, were collected during a Saturday without the HVAC system operating. In 2010, two additional indoor air samples were collected with the HVAC system on. The report *Additional Indoor Air Sampling Report* (AMEC, 2010) contains the full set of data for the 1155 E. Arques Ave. Building. The table below presents the 2005 sampling event that contained the highest detection, the 2009 event and the 2010 event

Table 3

Indoor Air Sampling Results for 2005, 2009 and 2010 for PCE and TCE.

	Sample Date	PCE	TCE
		(µg/m3)	(µg/m3)
R-1B	12/17/2005	1.3	<0.16
R-1B	12/19/2009	0.21	<0.17
R-1B	6/5/2010	<0.22	<0.18
O-1B	12/17/2005	1.2	<0.19
O-1B	12/19/2009	0.57	<0.33
IA-1 Indoor sample location, within a classroom			
IA-1B	12/17/2005	1.3	0.62
IA-1B	3/18/2006	0.68	1.4
IA-1B	12/19/2009	0.64	0.79
IA-1B (Lab Duplicate)	12/19/2009	0.63	0.79
IA-2B	12/17/2005	1.8	1.2

IA-2B	12/19/2009	1	2.4
IA-2B	6/5/2010	<0.21	<0.17
IA-3 Indoor sample location, within a classroom			
IA-3B	12/17/2005	2.2	0.99
IA-3B	12/19/2009	0.67	0.5
IA-4 Indoor sample location, within a classroom			
IA-4	10/23/2005	0.66	<0.19
IA-4B	12/17/2005	2.3	0.77
IA-4B	12/19/2009	0.54	0.39
IA-5B	12/17/2005	2.3	0.96
IA-5B	12/19/2009	0.54	0.36
IA-6 Indoor sample location, within a classroom			
IA-6B	12/17/2005	2.1	1.2
IA-6B (Field Duplicate)	12/17/2005	2	0.71
IA-6B (Lab Duplicate)	12/17/2005	2	0.72
IA-6B	12/19/2009	0.7	0.56
IA-6B	6/5/2010	<0.22	<0.17

As with building 1160 Kern Ave., indoor air results can be compared to U.S. EPA Regional Screening Levels (RSLs). However, the case of a daycare facility, it is commonly accepted to use the residential indoor air RSLs. The current residential RSL for PCE is 0.41 µg/m^3. The residential TCE RSLs for chronic exposure is 0.43 µg/m^3, and the not-to-exceed value is 2.0 µg/m^3

(please input on conclusions and recommendations)

Issues and Recommendations

Include a table/discussion of any new issues and recommendations (make this section consistent with the FYR guidance) identified since the completion date of the FYR).

Issues	Recommendations /Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)

Protectiveness Statements

Based on new information and/or actions taken since the Five-Year Review completion date, the protectiveness statement(s) for OU- [insert OU numbers] is/are being revised as follows:

For each OU addressed in this addendum, provide a protectiveness determination.

If the site is construction complete, provide a sitewide protectiveness statement.

Next Five-Year Review

The next five-year review will be completed on [*insert date*], five years after the signature of the last five-year review report.

_____ Date_____

[*Insert Name*]
Superfund Division Director

Attachments:

[*references, monitoring data, study results (if applicable)*]

Appendix A

Table 3 – Historic Indoor Air Sampling at Kindercare (1155 East Arques Avenue)

	Sample Date	PCE	TCE	cis-1,2-DCE	1,1,1-TCA	Freon-113
		(µg/m3)	(µg/m3)	(µg/m3)	(µg/m3)	(µg/m3)
R-1 Outdoor sample location on roof near HVAC unit						
R	10/23/2005	0.52	<0.18	<0.14	<0.19	0.85
R-1B	12/17/2005	1.3	<0.16	<0.12	<0.16	0.62
R-1B	3/18/2006	<0.24	<0.19	<0.14	<0.19	0.71
R-1B	4/8/2006	<0.24	<0.19	<0.14	<0.19	0.69
R-1B	11/4/2006	<0.22	<0.17	<0.13	<0.18	0.57
R-1B	5/5/2007	<0.23	<0.18	<0.13	<0.18	0.58
R-1B (Lab duplicate)	5/5/2007	<0.23	<0.18	<0.13	<0.18	0.56
R-1B	11/10/2007	<0.24	<0.19	<0.14	<0.20	0.58
R-1B	5/17/2008	<0.25	<0.20	<0.14	<0.20	0.6
R-1B	12/20/2008	<0.22	<0.17	<0.13	<0.18	0.59
R-1B	12/19/2009	0.21	<0.17	<0.12	<0.17	0.5
R-1B	6/5/2010	<0.22	<0.18	<0.13	<0.18	0.51
O-1 Outdoor sample location in northern play area						

O-1	10/23/2005	0.81	<0.18	<0.13	<0.18	0.78
O-1B	12/17/2005	1.2	<0.19	<0.14	<0.19	0.62
O-1B	3/18/2006	<0.33	<0.26	<0.19	<0.27	0.68
O-1B	4/8/2006	<0.24	0.33	<0.14	<0.20	0.68
O-1B	11/4/2006	<0.23	<0.18	<0.13	<0.18	0.62
O-1B	5/5/2007	<0.20	<0.15	<0.11	<0.16	0.6
O-1B	11/10/2007	<0.21	<0.17	<0.12	<0.17	0.57
O-1B	5/17/2008	<0.23	<0.18	<0.14	<0.19	0.63
O-1B	12/20/2008	<0.21	<0.17	<0.12	<0.17	0.68
O-1B	12/19/2009	0.57	<0.33	<0.24	<0.34	0.51
O-1B	12/20/2008	<0.21	<0.17	<0.12	<0.17	0.68
O-1B	12/19/2009	0.57	<0.33	<0.24	<0.34	0.51

IA-1 Indoor sample location, within a classroom

IA	10/23/2005	0.49	<0.19	<0.14	<0.20	0.85
IA-1B	12/17/2005	1.3	0.62	<0.12	0.18	0.78
IA-1B	3/18/2006	0.68	1.4	<0.14	0.68	0.93
IA-1B	4/8/2006	0.65	0.64	<0.12	0.75	0.94
IA-1B (Field Duplicate)	4/8/2006	0.58	0.72	<0.12	0.72	0.99
IA-1B (Lab Duplicate)	4/8/2006	0.62	0.69	<0.12	0.84	1.1
IA-1B	11/4/2006	0.49	0.72	<0.13	0.89	0.61
IA-1B	5/5/2007	0.43	0.88	<0.13	0.96	0.67
IA-1B	11/10/2007	0.31	0.35	<0.11	0.52	0.6
IA-1B (Field Duplicate)	11/10/2007	0.28	0.32	<0.12	0.61	0.58
IA-1B	5/17/2008	<0.23	0.18	<0.14	<0.19	0.54

IA-1B (DUP-1)	5/17/2008	<0.24	<0.19	<0.14	<0.20	0.56
IA-1B	12/20/2008	0.35	0.37	<0.13	<0.18	0.67
IA-1B	12/19/2009	0.64	0.79	<0.13	<0.18	0.72
IA-1B (Lab Duplicate)	12/19/2009	0.63	0.79	<0.13	<0.18	0.7

IA-2 Indoor sample location, central area outside of classrooms

IA-2	10/23/2005	0.44	<0.18	<0.14	<0.19	0.82
IA-2B	12/17/2005	1.8	1.2	<0.13	0.19	0.89
IA-2B	3/18/2006	0.92	1.6	<0.18	<0.25	0.98
IA-2B	4/8/2006	1.1	1.7	<0.14	0.27	1.3
IA-2B	11/4/2006	0.69	0.89	<0.14	0.34	0.66
IA-2B	5/5/2007	0.38	0.73	<0.11	0.18	0.66
IA-2B (Field Duplicate)	5/5/2007	0.49	0.9	<0.13	<0.18	0.66
IA-2B	11/10/2007	<0.23	<0.18	<0.13	<0.18	0.57
IA-2B	5/17/2008	<0.24	<0.19	<0.14	<0.20	0.56
IA-2B	12/20/2008	0.27	0.22	<0.13	<0.18	0.62
IA-2B	12/19/2009	1	2.4	<0.13	2.2	0.81
IA-2B	6/5/2010	<0.21	<0.17	<0.12	<0.17	0.66

IA-3 Indoor sample location, within a classroom

IA-3	10/23/2005	0.5	<0.18	<0.14	<0.19	0.82
IA-3 (Field Duplicate)	10/23/2005	0.45	<0.19	<0.14	<0.20	0.79
IA-3B	12/17/2005	2.2	0.99	<0.13	<0.18	0.83
IA-3B	3/18/2006	0.97	0.92	<0.14	<0.20	0.79
IA-3B	4/8/2006	0.99	0.72	<0.14	<0.20	0.99
IA-3B	11/4/2006	0.44	0.46	<0.13	<0.18	0.63

IA-3B (Lab Duplicate)	11/4/2006	0.5	0.52	<0.13	<0.18	0.72
IA-3B	5/5/2007	0.35	0.41	<0.20	<0.28	0.64
IA-3B	11/10/2007	0.53	<0.36	<0.26	<0.36	0.58
IA-3B	5/31/2008	0.17	<0.13	<0.18	0.53	30
IA-3B	12/20/2008	0.39	0.37	<0.13	<0.18	0.62
IA-3 (Field Duplicate)	12/20/2008	0.46	0.3	<0.13	<0.18	0.6
IA-3B (Lab Duplicate)	12/20/2008	0.43	0.3	<0.13	<0.18	0.62
IA-3B	12/19/2009	0.67	0.5	<0.12	<0.17	0.67

IA-4 Indoor sample location, within a classroom

IA-4	10/23/2005	0.66	<0.19	<0.14	<0.19	0.8
IA-4B	12/17/2005	2.3	0.77	<0.14	<0.19	0.83
IA-4B	3/18/2006	0.76	0.71	<0.14	<0.19	0.76
IA-4B	4/8/2006	0.89	0.52	<0.14	<0.20	0.86
IA-4B	11/4/2006	0.35	0.34	0.16	<0.17	0.64
IA-4B	5/5/2007	0.29	0.27	<0.13	<0.18	0.63
IA-4B	11/10/2007	0.38	0.26	<0.13	<0.18	0.62
IA-4B	5/17/2008	<0.23	<0.18	<0.13	<0.18	0.59
IA-4B	12/20/2008	0.35	0.28	<0.13	<0.18	0.62
IA-4B	12/19/2009	0.54	0.39	<0.13	<0.18	0.56

IA-5 Indoor sample location, not within a classroom

IA-5	10/23/2005	0.41	<0.19	<0.14	<0.20	0.83
IA-5 (Lab Duplicate)	10/23/2005	0.4	<0.19	<0.14	<0.20	0.79
IA-5B	12/17/2005	2.3	0.96	<0.14	<0.19	0.96

IA-5B	3/18/2006	1.4	0.82	<0.14	<0.19	0.84
IA-5B	4/8/2006	1.1	0.69	<0.14	<0.20	1.1
IA-5B	11/4/2006	0.48	0.4	<0.12	<0.16	0.68
IA-5B	5/5/2007	0.33	0.33	<0.11	<0.15	0.64
IA-5B	11/10/2007	<0.23	<0.18	<0.13	<0.18	0.6
IA-5B	5/17/2008	<0.22	<0.17	<0.13	<0.18	0.62
IA-5B	12/20/2008	<0.22	<0.18	<0.13	<0.18	0.62
IA-5B	12/19/2009	0.54	0.36	<0.12	<0.16	0.55

IA-6 Indoor sample location, within a classroom

IA-6B	12/17/2005	2.1	1.2	<0.11	0.16	0.71
IA-6B (Field Duplicate)	12/17/2005	2	0.71	<0.14	<0.19	0.74
IA-6B (Lab Duplicate)	12/17/2005	2	0.72	<0.14	<0.19	0.72
IA-6B	3/18/2006	0.88	0.99	<0.14	<0.20	0.89
IA-6B	4/8/2006	1	0.61	<0.16	<0.21	1
IA-6B	11/4/2006	0.42	0.56	<0.11	<0.15	0.64
IA-6B (Field Duplicate)	11/4/2006	0.42	0.57	<0.10	<0.14	0.62
IA-6B	5/5/2007	0.37	0.47	<0.13	<0.18	0.6
IA-6B	11/10/2007	0.32	0.34	<0.13	<0.18	0.59
IA-6B	5/17/2008	<0.22	0.27	<0.13	<0.18	0.58
IA-6B	12/20/2008	0.36	0.31	0.14	<0.18	0.59
IA-6B	12/19/2009	0.7	0.56	<0.13	0.26	0.62
IA-6B (Field Duplicate)	12/19/2009	0.66	0.48	<0.14	<0.19	0.66
IA-6B	6/5/2010	<0.22	<0.17	<0.13	<0.18	0.68